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GANNETT FLEMING CORDRY AND CARPENTER INC HARRISBURG PA F/B 13/13
NATIONAL DAM INSPECTION PROGRAM. BRIER CREST WOODS DAM. DELANAR--ETC(U)
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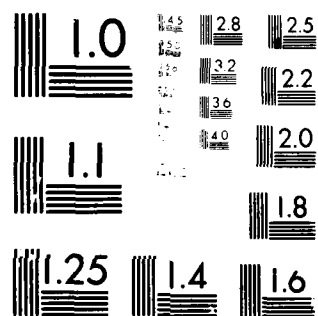
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Monroe County, PA
Delaware River Basin
DELAWARE RIVER BASIN,
TRIBUTARY TO TUNKHANNOCK CREEK, MONROE COUNTY,
PENNSYLVANIA

~~BRIER CREST WOODS DAM~~

(NDI ID No. PA-00879
DER ID No. 45-245)

BRIER CREST WOODS, INC.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
P.O. Box 1963
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DACW 31-80 C -0017 1
For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

FEBRUARY 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN
TRIBUTARY TO TUNKHANNOCK CREEK, MONROE COUNTY
PENNSYLVANIA

BRIER CREST WOODS DAM

NDI ID No. PA-00879
DER ID No. 45-245

BRIER CREST WOODS, INC.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

FEBRUARY 1980

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<u>Appendix</u>	<u>Title</u>
A	Checklist - Engineering Data.
B	Checklist - Visual Inspection.
C	Photographs.
D	Hydrology and Hydraulics.
E	Plates.
F	Geology.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam: Brier Crest Woods Dam
NDI ID No. PA-00879
DER ID No. 45-245

Size: Small (16 feet high; 247 acre-ft)

Hazard Classification: Significant

Owner: Brier Crest Woods, Inc.
Vincent Marconi, President
P.O. Box 1
Blakeslee, Pa. 18610

State Located: Pennsylvania

County Located: Monroe

Stream: Tributary to Tunkhannock Creek

Date of Inspection: 14 November 1979

Based on visual inspection, available records, calculations, and past operational performance, Brier Crest Woods Dam is judged to be in good condition. The existing spillway will pass the Probable Maximum Flood (PMF), which is twice the Spillway Design Flood (SDF), with 0.2 foot of freeboard. Based on the criteria and the downstream conditions, the SDF is the 1/2 PMF. If the low areas on the top of the dam were filled to the design elevation, the freeboard would increase to 0.5 foot. The spillway capacity is rated as adequate.

No stability problems were evident for the embankment. The spillway weir meets recommended guidelines for stability.

The ability of the outlet works to function is uncertain.

Maintenance procedures for the dam and appurtenant structures are inadequate.

The following studies and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, without delay:

- (1) Ensure the operational adequacy of the outlet works, and operate it on a regular basis.
- (2) Establish an adequate grass cover on the downstream slope.
- (3) Fill in low areas at the top of the dam.

In addition, the Owner should institute the following operational and maintenance procedures:

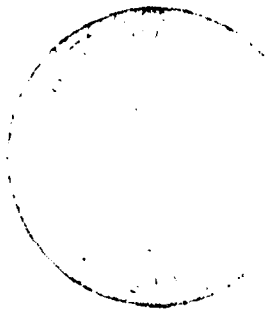
- (1) Develop a detailed emergency operation and warning system for Brier Crest Woods Dam.
- (2) During periods of unusually heavy rains, provide round-the-clock surveillance of Brier Crest Woods Dam. Have sufficient personnel available to remove debris that may collect at the spillway bridge.
- (3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.
- (4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.
- (5) Institute a maintenance program so that all features of the dam are properly maintained.

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BRIER CREST WOODS DAM

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.



Frederick Futchko

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 21 March 1980

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT,
CORPS OF ENGINEERS

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 10 APR 1980

BRIER CREST WOODS DAM



Overview

DELAWARE RIVER BASIN
TRIBUTARY TO TUNKHANNOCK CREEK, MONROE COUNTY

PENNSYLVANIA

BRIER CREST WOODS DAM

NDI ID No. PA-00879
DER ID No. 45-245

BRIER CREST WOODS, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

FEBRUARY 1980

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Brier Crest Woods Dam is a homogeneous earthfill embankment with a toe drain. The dam, including the spillway, is 790 feet long and is 16 feet high at maximum section. The spillway is located near the middle of the dam. It is a concrete gravity weir with a concrete exit channel apron. A reinforced concrete bridge crosses

over the spillway. The spillway crest is 25 feet long and is 5.0 feet below the design top elevation of the dam. Vertical walls that retain the embankment act as approach and exit channel walls. The walls also act as bridge abutments to support the spillway bridge. The underside of the bridge is 4.0 feet above the spillway crest. The outlet works consists of a 12-inch diameter corrugated metal pipe in the spillway weir with a sluice gate at the upstream end. The gate operating mechanism extends up to the bridge railing. The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is included in Appendix F.

b. Location. Brier Crest Woods Dam is located on a tributary to Tunkhannock Creek in Tunkhannock Township, Monroe County, Pennsylvania. The dam is approximately 3.7 miles southeast of Blakeslee. Brier Crest Woods Dam is shown on the 1973 Photorevision to USGS Quadrangle, Blakeslee, Pennsylvania, at latitude N 41° 02' 50" and longitude W 75° 33' 15". A location map is shown on Plate E-1.

c. Size Classification. Small (16 feet high, 247 acre-feet).

d. Hazard Classification. Significant hazard. Downstream conditions indicate that a significant hazard classification is warranted for Brier Crest Woods Dam (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. Brier Crest Woods, Inc., Vincent Marconi, President, P.O. Box 1, Blakeslee, PA 18610.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Brier Crest Woods Dam was designed by Edward C. Hess Associates, Inc., Consulting Engineers of Stroudsburg, PA. The preliminary design was submitted to the Commonwealth in 1971. The Commonwealth, apparently suggested some changes to mitigate the environmental impact. The final design was submitted to the Commonwealth in April 1972. The Commonwealth issued a permit for construction in June 1972. Construction was started in the summer of 1972 by G. H. Litts and Son, Inc., Contractors of Marshalls Creek, PA., under the supervision of Edward C. Hess Associates. The dam was completed in September 1973. Clifford L. Dennis of Edward C. Hess Associates was the project engineer throughout design and construction.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. The outlet works is not used. Spillway discharge flows downstream to the confluence with Tunkhannock Creek.

1.3 Pertinent Data.

a.	<u>Drainage Area.</u> (square miles)	0.5
b.	<u>Discharge at Damsite.</u> (cfs.)	
	Maximum known flood at damsite	Unknown.
	Outlet works at maximum pool elevation	15
	Spillway capacity at maximum pool elevation	
	Design conditions	970
	Existing conditions	920
c.	<u>Elevation.</u> (feet above msl.)	
	Top of dam	
	Design conditions	1807.0
	Existing conditions	1806.7
	Maximum pool	
	Design conditions	1807.0
	Existing conditions	1806.7
	Normal pool (spillway crest)	1802.0
	Upstream invert outlet works	1791.7
	Downstream invert outlet works	1791.5
	Streambed at toe of dam	1791.0
d.	<u>Reservoir Length.</u> (miles)	
	Normal pool	0.33
	Maximum pool	0.38
e.	<u>Storage.</u> (acre-feet)	
	Normal pool	110
	Maximum pool (design)	247
f.	<u>Reservoir Surface.</u> (acres)	
	Normal pool	26.2
	Maximum pool (design)	28.5
g.	<u>Dam.</u>	
	<u>Type</u>	Homogeneous earthfill with toe drain.

g.	Dam. (cont'd)	
	<u>Length (feet)</u>	790
	<u>Height (feet)</u>	16
	<u>Topwidth (feet)</u>	44 (changes to 30 feet adjacent to spillway)
	<u>Side Slopes</u>	
	<u>Design</u>	
	Upstream	1V on 2.5H
	Downstream	1V on 2.5H (slopes flatten adjacent to spillway)
	<u>Zoning</u>	Earthfill with toe drain.
	<u>Cut-off</u>	Cutoff trench backfilled with embankment fill.
	<u>Grout Curtain</u>	None.
h.	<u>Diversion and Regulating Tunnel.</u>	None.
i.	<u>Spillway.</u>	
	<u>Type</u>	Concrete gravity weir.
	<u>Length of Weir (feet)</u>	25.0
	<u>Crest Elevation</u>	1802.0
	<u>Upstream Channel</u>	Reservoir, vertical concrete walls.
	<u>Downstream Channel</u>	Concrete apron.

j. Regulating Outlets.
Type.

One 12-inch
diameter
corrugated
metal pipe.

Length (feet)

13

Closure

Sluice gate at
intake at up-
stream end.

Access

On bridge over
spillway.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. Design data available for review included the following: approved design drawings, specifications, foundation data from test pits, and permit application reports.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Photographs in Appendix C and on Plates E-2 to E-5 in Appendix E. The embankment is shown on Photographs A through D. The spillway is shown on Photographs D through F. The outlet works is shown on Photographs D and E.

c. Design Considerations. Nothing was noted in the review of the design data that would cause concern. The specifications generally reflected good engineering practice.

2.2 Construction.

a. Data Available. Construction data available for review included construction progress reports prepared by the design engineer and correspondence regarding construction. The design engineer verbally amplified the construction reports.

b. Construction Considerations. The design engineer amplified the records to explain that some of the embankment material that was placed during the fall of 1972 came from a swamp in the reservoir area. Consequently, the material was quite wet and drying the material sufficiently to meet density requirements was time consuming. He pointed out, however, that although it was difficult, the Contractor did dry the material sufficiently to compact the fill to the required density. He stated that no other problems arose during construction. The available information indicates that the embankment was well constructed.

2.3 Operation. There are no formal records of operation. There have been no formal inspections of the dam since its construction. There are no records of any problems with the dam.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER). The Owner made available a representative for information during the visual inspection. The design engineer researched his files and provided information at the request of the inspection team.

b. Adequacy. The type and amount of available design data and other engineering data are somewhat limited; the assessment is based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is good. Some deficiencies were observed as noted below. A sketch of the dam with the locations of deficiencies is presented on Exhibit B-1 in Appendix B. Survey information acquired for this report is summarized in Appendix B. On the day of the inspection, the pool was at spillway crest. Rainfall immediately preceding the inspection resulted in very wet soil conditions.

b. Embankment. The embankment is in good condition. The top of the dam is used as an access road; it is not covered with vegetation. Vehicular traffic has created minor depressions, which were full of water on the day of the inspection (Photograph A). The upstream slope is protected by riprap, which is in good condition (Photograph A). The grass on the downstream slope is in poor condition. It is thin and many bare areas exist. Surface runoff has eroded many very shallow rills over most of the downstream slope (Photograph B). Soil eroded from the embankment covers the toe drains, which were not evident during the inspection (Photograph C). A 0.25-gpm flow was observed along the downstream toe of the dam to the right of the spillway. Its source could not be determined.

The survey performed for this inspection (Appendix B) reveals that low areas exist on the top of the embankment to the left of the spillway. The lowest area is 0.3 foot below design elevation. The survey section shown in Appendix B has flatter slopes and a narrower top width than the typical section shown on Plate E-3 in Appendix E.

c. Appurtenant Structures. The spillway is in good condition. No deficiencies were observed at either the weir or the exit channel apron. The sidewalls of the exit channel apron, which also act as the bridge abutments, have a shrinkage crack on each side approximately coincident with the axis of the dam. The weep holes in these walls were trickling (Photograph F). The bridge deck is in good condition.

The outlet works is located at the spillway. It consists of a corrugated metal pipe extending through the weir with a sluice gate at the upstream end. The pipe is rusty. The Owner's representative could not locate the key to the padlock that secures the gate operating mechanism to the bridge railing (Photograph E). He did not recollect the gate ever being operated.

d. Reservoir Area. The watershed is mostly wooded. The only development is minor and is part of the Brier Crest Woods Development. Slopes in the watershed are generally mild.

e. Downstream Conditions. The valley at the damsite is relatively wide and flat. About 0.2 mile downstream, the valley narrows and steepens. It then passes below Pa. Route 903 in a small culvert. Just beyond Route 903, the stream drops very rapidly to its confluence with Tunkhannock Creek, which is about 0.4 mile downstream from the dam. Were the dam to fail, damage would probably occur at both a dwelling and a ski shop. Downstream conditions showing the probable limits of flooding from a dam failure are sketched in Appendix D.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the spillway crest level with excess inflow discharging over the spillway and into the downstream channel. The outlet works is not used.

4.2 Maintenance of Dam. The Owner's representative reported that maintenance of the dam was infrequent. He also reported that inspections were infrequent, informal, and not in detail. Apparently, some inspections of the dam are being performed as the design engineer was recently called to the site to investigate a minor leak in the sluice gate.

4.3 Maintenance of Operating Facilities. The outlet works is not maintained.

4.4 Warning Systems in Effect. The Owner's representative stated that he was not aware of any emergency operation and warning system.

4.5 Evaluation of Operational Adequacy. The maintenance of the outlet works is inadequate. Although the embankment and spillway are in good condition, the lack of formal maintenance procedures could result in eventual deterioration of the dam. Inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life should the dam fail.

SECTION 5
HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The available data for the spillway indicates that the design was based on a Curve "C" discharge of 720 cfs that was required by the Commonwealth. The design head was 4 feet, with 1 foot of freeboard provided. The underside of the spillway bridge was set at the design head elevation. The design spillway capacity used in this Report is 973 cfs, and it was computed using the maximum available head of 5.0 feet for design conditions.

b. Experience Data. No records of maximum pool levels are available.

c. Visual Observations.

(1) General. The visual inspection of Brier Crest Woods Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low areas on the top of the dam limit the existing spillway capacity to less than the maximum capacity.

(3) Appurtenant Structures. The design elevation of the underside of the spillway bridge is lower than the design top of dam elevation, which would cause pressure flow when water is near the top of the dam. Discharges under pressure flow would be less than under a free overfall condition. In computing the existing spillway capacity and in evaluating the spillway adequacy, the effect of the above condition was included. There is the potential for the bridge to collect debris during storms. This would reduce the spillway capacity. In computing the existing spillway capacity, the effect of debris was not considered.

The ability of the outlet works to function is uncertain. At present, it cannot be relied upon to draw down the reservoir.

(4) Reservoir Area. No conditions were observed in the watershed that might present significant hazard to the dam.

(5) Downstream Conditions. No conditions were observed downstream from the dam that would reduce the hydraulic capacity of the spillway. A failure of the dam would result in a significant discharge along Pa. Route 903. This would probably occur as sheet flow. It would cause damage to a ski shop and to the basement of a dwelling. Loss of life from a failure is possible but unlikely. Downstream from the confluence with Tunkhannock Creek, there are no structures adjacent to the stream for 2.5 miles. The downstream conditions indicate that a significant hazard classification is warranted for Brier Crest Woods Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small) and hazard potential (Significant) of Brier Crest Woods Dam is between the 100-Year Flood and one-half of the Probable Maximum Flood (PMF). Because of the possibility of loss of life downstream, the one-half PMF is selected as the SDF for Brier Crest Woods Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of the dam is based on existing conditions. The effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Brier Crest Woods Dam can pass the PMF with 0.2 foot of freeboard. If the low areas at the top of the dam were filled in, the freeboard would increase to 0.5 foot.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because the dam can pass the PMF, which is twice the SDF, the spillway capacity is rated as adequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Brier Crest Woods Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. The depressions caused by vehicular traffic on the top of the dam are of no concern. The erosion on the downstream slope, which was caused by surface runoff, is not a hazard at present. Long-term neglect could worsen the situation. The design engineer reported that the grass cover at the end of construction was adequate. The reason for the poor growth of the grass is unknown. The design engineer reported that the toe drains were constructed as shown on Plate E-3. The soil which covers them should not affect their proper functioning. The flow that was observed along the toe is insignificant. In all probability it was surface runoff.

The low areas on the top of the embankment probably resulted from settlement. The design engineer reported that the template of the section surveyed for this inspection was approximately the same as the as-constructed template. He reported that the design drawings do not clearly reflect the template near the spillway.

(3) Appurtenant Structures. The shrinkage cracks in the exit channel walls are not a hazard at present; they do have the potential to eventually start spalling. The minor flow from the weep holes indicates that they are probably functioning correctly.

The outlet works operation is assessed in Section 5. The rusty outlet works pipe is of no concern. In essence, the pipe just acts as a form for the surrounding spillway weir concrete.

b. Design and Construction Data. The design engineer reported that no stability analysis was performed for the

embankment. He also reported that an analysis for the spillway weir was performed but that it could not be located in his files.

For this report, the stability of the spillway weir was checked under the maximum loading condition. Earth pressure and uplift were used in the analysis. For the maximum loading condition, pool level at design top of dam, the resultant was within the middle third of the base. Both the resistance to sliding and toe pressure were adequate. The stability of the spillway weir meets the criteria established by the Office of the Chief of Engineers (OCE) for stability of gravity structures.

c. Operating Records. There are no formal records of operation. According to available data, no stability problems have occurred over the operational history of the dam.

d. Post-construction Changes. There have been no post-construction changes to Brier Crest Woods Dam.

e. Seismic Stability. Brier Crest Woods Dam is located in Seismic Zone 1. Earthquake loadings are not considered to be significant for small dams located in Zone 1 when there are no readily apparent stability problems. As there are no readily apparent stability problems, the ability of the dam to withstand an earthquake is assumed to be adequate.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Brier Crest Woods Dam is judged to be in good condition. Based on existing conditions, the spillway will pass the PMF which is twice the Spillway Design Flood (SDF), with 0.2 foot of freeboard. Based on the criteria and the downstream conditions, the SDF is the 1/2 PMF. If the low areas on the top of the dam were filled to the design elevation, the freeboard would increase to 0.5 foot. The spillway capacity is rated as adequate.

(2) No stability problems were evident for the embankment.

(3) The spillway weir meets OCE guidelines for stability under the maximum operating condition.

(4) The ability of the outlet works to function is uncertain.

(5) Maintenance procedures for the dam and appurtenant structures are inadequate.

(6) A summary of the features and observed deficiencies is listed below:

<u>Feature and Location</u>	<u>Observed Deficiency</u>
<u>Embankment:</u>	Low areas at top; minor erosion of downstream slope; poor vegetation on downstream slope.
<u>Spillway:</u>	Shrinkage cracks in exit channel sidewalls.
<u>Outlet Works:</u>	Uncertain operation.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented without delay.

d. Necessity for Further Investigations. Accomplishment of remedial measures will not require further investigations by the Owner.

7.2 Recommendations and Remedial Measures.

a. The following studies and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, without delay:

(1) Ensure the operational adequacy of the outlet works.

(2) Establish an adequate grass cover on the downstream slope.

(3) Fill in low areas at the top of the dam.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Brier Crest Woods Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Brier Crest Woods Dam. Have sufficient personnel available to remove debris that may collect at the spillway bridge.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program so that all features of the dam are properly maintained.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE INAME OF DAM: Brier Crest Woods
NDI ID NO.: PA-00879 DER ID NO.: 45-245Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	DESIGN DRAWING. SEE PLATES E-2 TO E-5
REGIONAL VICINITY MAP	SEE PLATE E-1
CONSTRUCTION HISTORY	BUILT 1972 TO 1973
TYPICAL SECTIONS OF DAM	SEE PLATE E-3
OUTLETS: Plan Details Constraints Discharge Ratings	SEE PLATE E-4 NO RATINGS AVAILABLE.

A-1

ENGINEERING DATA

Sheet 2 of 4

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	WATER AND POWER RESOURCES BOARD ANALYSIS OF DESIGN
GEOLOGY REPORTS	AVAILABLE SOIL DATA - SEE PLATE E-3 AND MATERIALS INVESTIGATION BELOW.
DESIGN COMPUTATIONS: Hydrology and Hydraulics (H & H) Dam Stability Seepage Studies	STABILITY AND SEEPAGE - NONE
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	IN FILE: 2 SOIL SAMPLES ① SILTY SAND: $D_{100} = 1/2"$, $D_{50} = \#100 \pm$, $41\% < \#200$, PERM 1.33×10^{-6} cm/sec ② SANDY SILT: $D_{100} = 1"$, $64\% < \#200$, PERM 5.26×10^{-7} cm/sec
POSTCONSTRUCTION SURVEYS OF DAM	NONE

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	SIRE
MONITORING SYSTEMS	NONE
MODIFICATIONS	NONE
HIGH POOL RECORDS	NONE
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None
SPILLWAY: Plan Sections Details	See Plate E-4
OPERATING EQUIPMENT: Plans Details	See Plate E-4
PREVIOUS INSPECTIONS Dates Deficiencies	None

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Brier Crest Woods County: Monroe State: Pennsylvania
NDI ID No.: PA-00879 DER ID No.: 45-245
Type of Dam: Zoned Earthfill Hazard Category: Significant
Date(s) Inspection: 14 November 1979 Weather: Cloudy - Windy Temperature: 40-45°F

Soil Conditions - Very Wet

Pool Elevation at Time of Inspection: 1802.0 msl/Tailwater at Time of Inspection: 1791.0 msl

Inspection Personnel:

D. Wilson (GFCC)

D. Ebersole (GFCC)

A. Whitman (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	DOWNSTREAM Slope: ALMOST NO VEGETATION, SHALLOW SURFACE RUNOFF SWALES ON ENTIRE SLOPE	
CREST ALIGNMENT: Vertical Horizontal	HORIZ. - NO DEFICIENCIES VERT. - SEE SURVEY DATA FOLLOWING INSPECTION FORMS	
RIPRAP FAILURES	GOOD CONDITION	

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No deficiencies	
ANY NOTICEABLE SEEPAGE	SWALE ALONG DOWNSTREAM TOE. FLOW OF ABOUT 0.25 gpm IN SWALE TO RIGHT OF SPILLWAY.	Flow could be SURFACE RUNOFF.
STAFF GAGE AND RECORDER	None	
DRAINS	Not evident from visual inspection.	

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	12" CMP IN CONCRETE SPILLWAY WEIR.	
INTAKE STRUCTURE	SUBMERGED	
OUTLET STRUCTURE	PIPE OUTFALLS AT TOE OF SPILLWAY WEIR	
OUTLET CHANNEL	SEE SPILLWAY	
EMERGENCY GATE	OPERATOR EXTENDS TO BRIDGE OVERHEAD.	OWNER'S REPRESENTATIVE COULD NOT LOCATE KEY TO PADLOCK.

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	GOOD CONDITION	
APPROACH CHANNEL	RESERVOIR	
DISCHARGE CHANNEL	SHRINKAGE CRACKS EXTEND ALONG BRIDGE ABUTMENT CONCRETE.	TRICKLE FROM SOME WEIR HOLES.
BRIDGE AND PIERS	NO PIERS BRIDGE IN GOOD CONDITION.	

0.51

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE AT SITE ▲	
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER	NONE AT SITE ▼	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	No deficiencies	
SLOPES	MILD AT DAMSITE, VERY STEEP AT DAMAGE CENTER.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	1 dwelling 1 COMMERCIAL STRUCTURE	SEE SKETCH IN APPENDIX D.

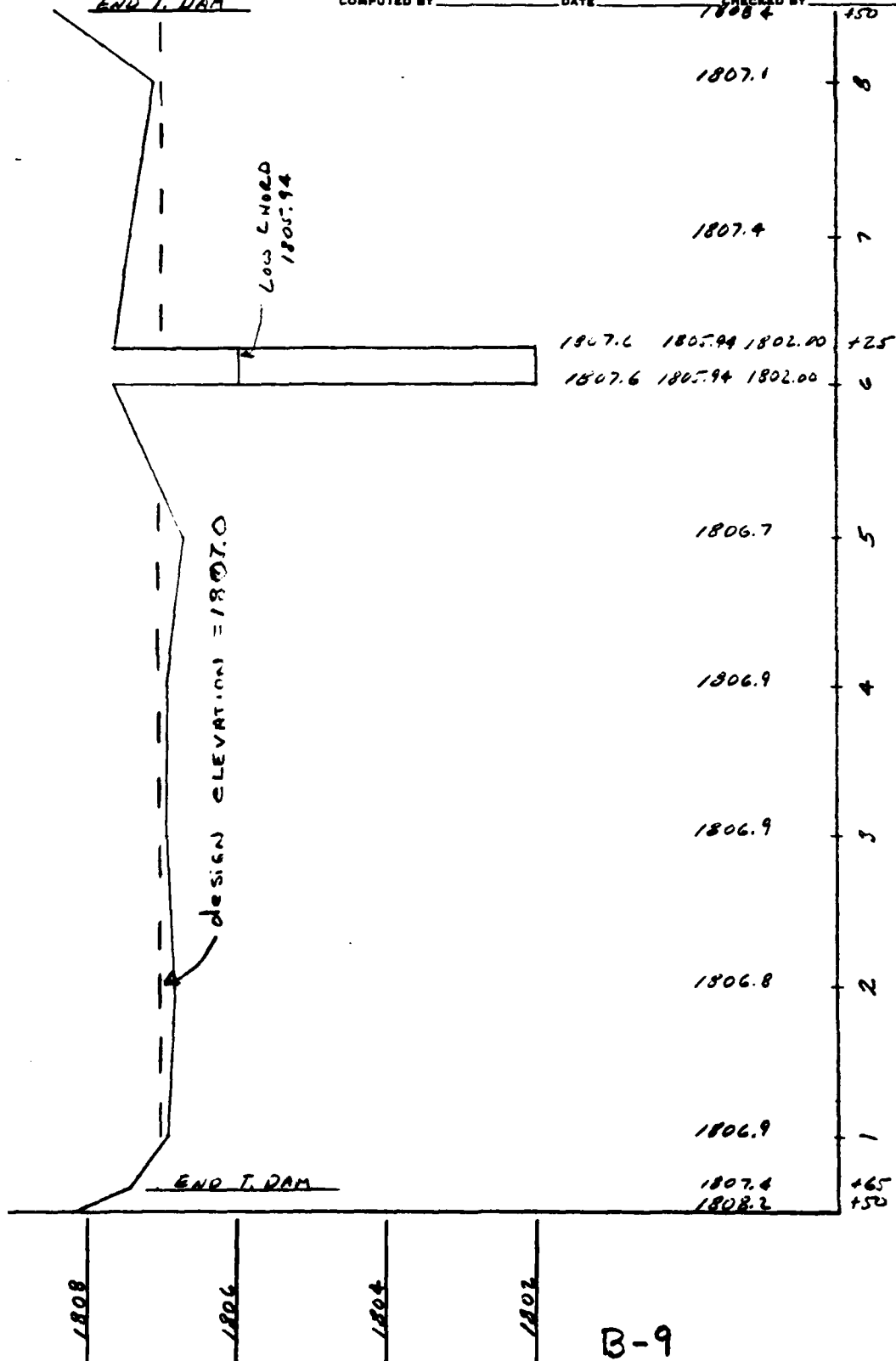
RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	MILD	
SEDIMENTATION	No Repaired or observed problems.	
WATERSHED DESCRIPTION	ABOUT 40% SPARSELY developed by woods. Brier Creek Woods. REMAINDER WOODED.	

GANNETT FLEMING CORDRY
AND CARPENTER, INC.
HARRISBURG, PA.
END T. DAM

SUBJECT _____ FILE NO. _____
SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY 1808.4 DATE _____

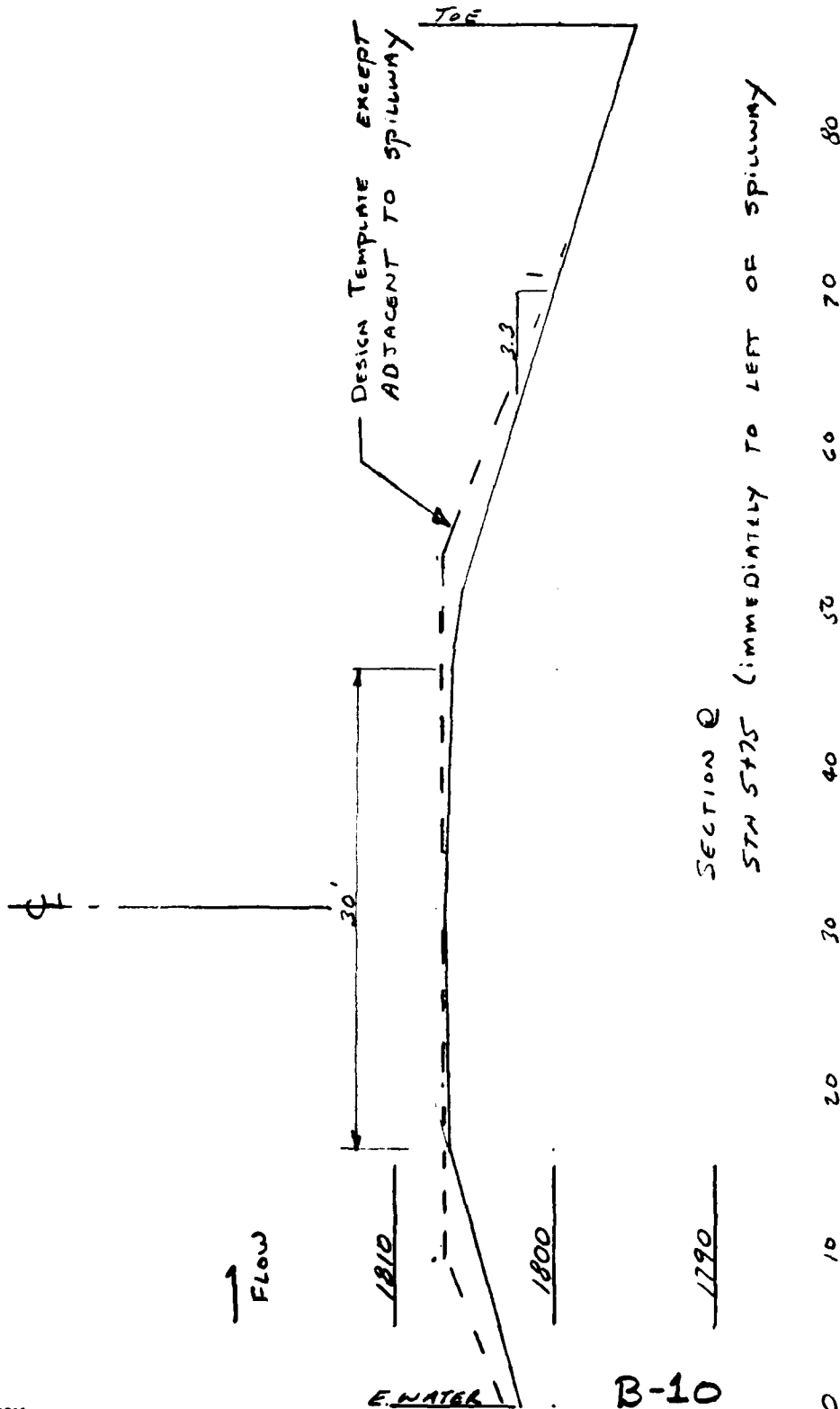


BEIRCK CREST WOODS DAM
Profile - Top of DAM

B-9

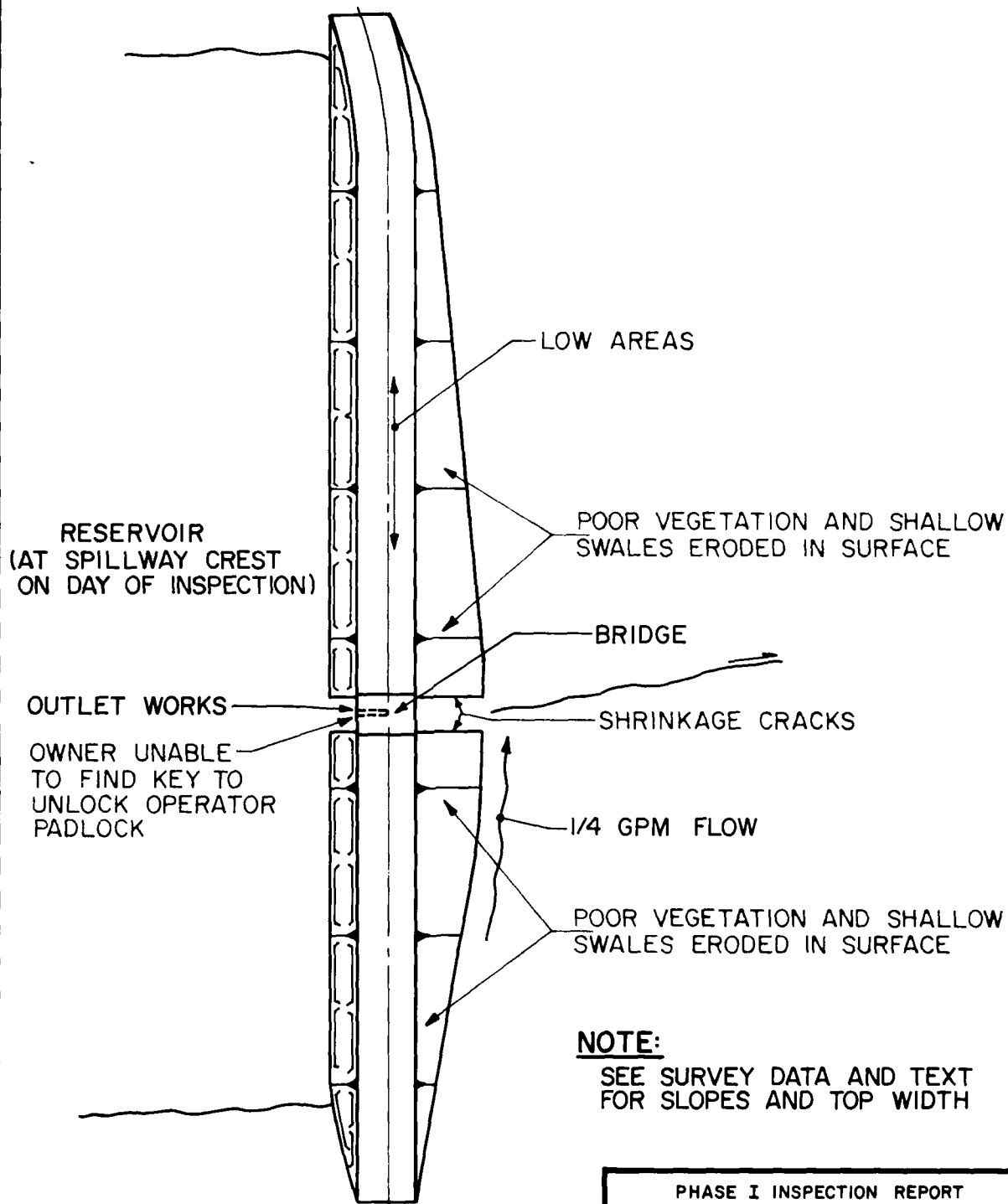
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SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPLETED BY _____ DATE _____ CHECKED BY _____ DATE _____



BRIER CREST WOODS DAM
SCALE: 1" = 10'

B-10



NOTE:

SEE SURVEY DATA AND TEXT
FOR SLOPES AND TOP WIDTH

NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIER CREST WOODS DAM

BRIER CREST WOODS, INC.

RESULTS OF
VISUAL INSPECTION

FEBRUARY 1980

EXHIBIT B-1

APPENDIX C
PHOTOGRAPHS

BRIER CREST WOODS DAM

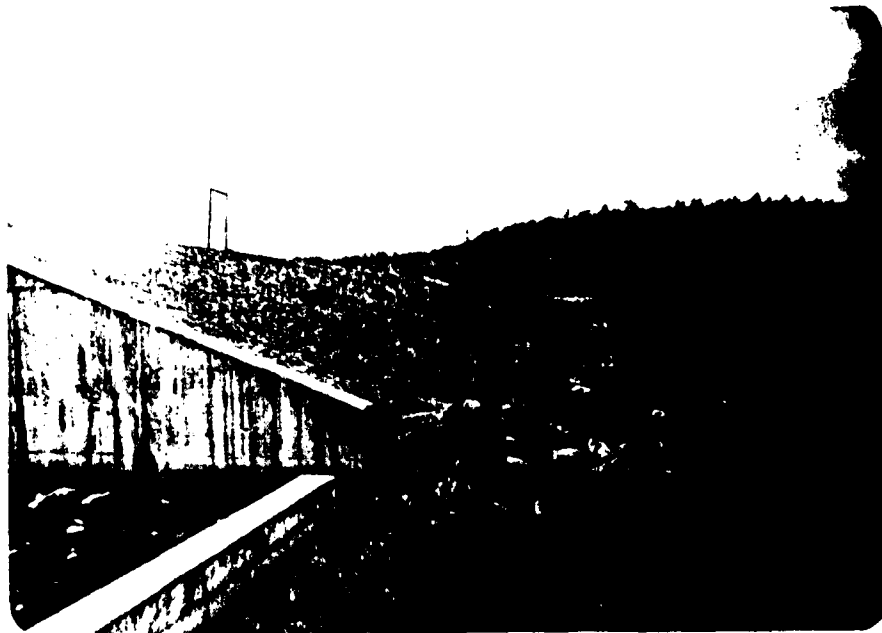


A. Upstream Slope

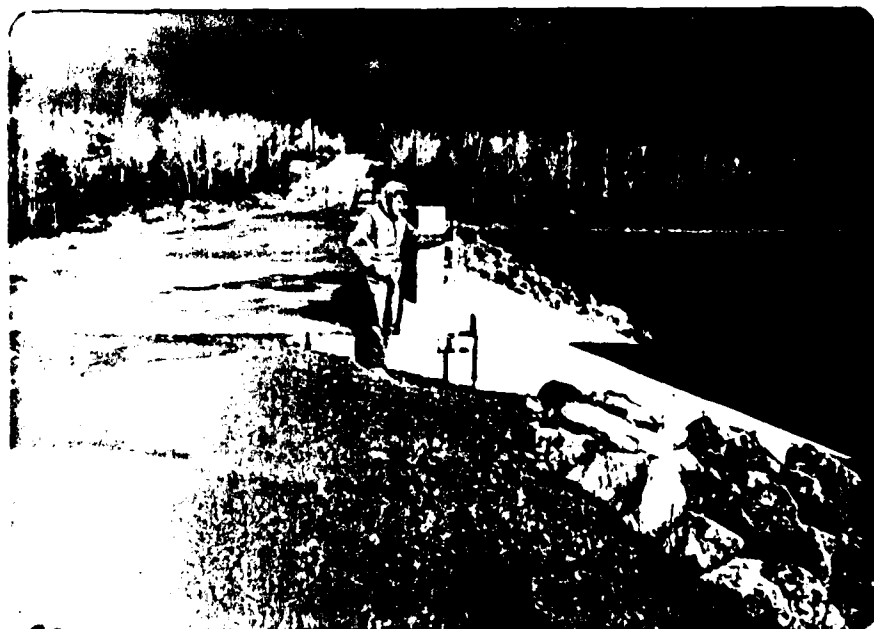


B. Downstream Slope

BRIER CREST WOODS DAM

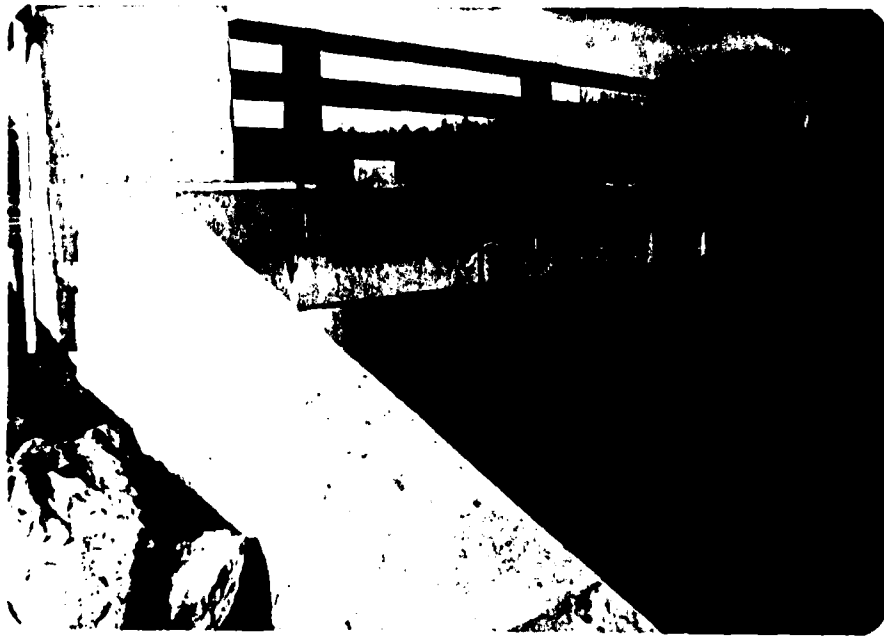


C. Downstream Slope



D. Spillway Bridge

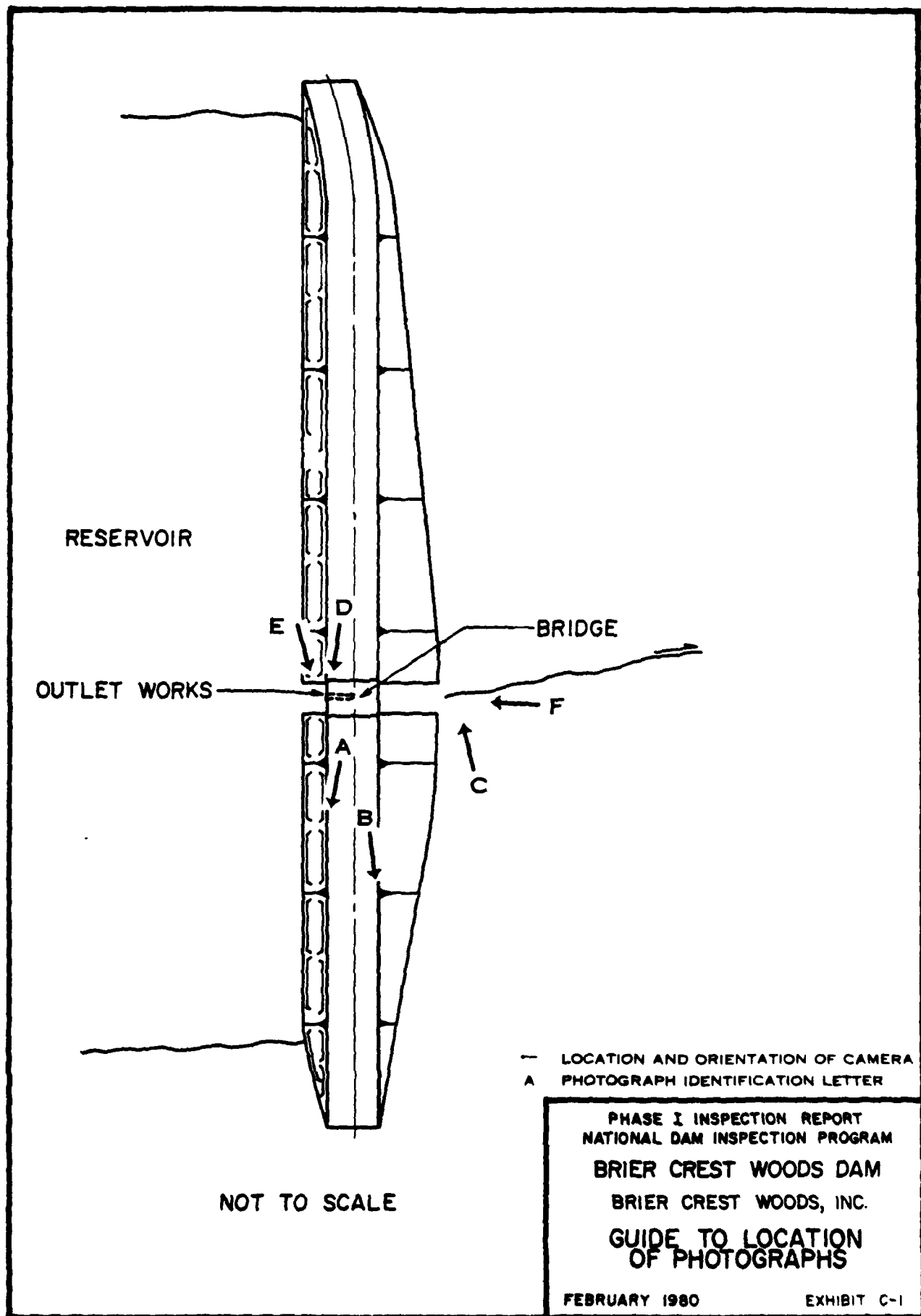
BRIER CREST WOODS DAM



E. Spillway Approach



F. Spillway



RESERVOIR

E

D

BRIDGE

OUTLET WORKS

F

A

B

C

— LOCATION AND ORIENTATION OF CAMERA
A PHOTOGRAPH IDENTIFICATION LETTER

NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIER CREST WOODS DAM

BRIER CREST WOODS, INC.

GUIDE TO LOCATION
OF PHOTOGRAPHS

FEBRUARY 1980

EXHIBIT C-1

APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

- (a) There is a high hazard to loss of life from large flows downstream of the dam.
- (b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.
- (c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

DELAWARE

River Basin

Name of Stream: TRIBUTARY TO TUNKHANNOCK CREEK

Name of Dam: BRIER CREST WOODS

NDI ID No.: PA-00879

DER ID No.: 45-245

Latitude: N 41° 02' 50" Longitude: 75° 33' 15"

Top of Dam Elevation: 1807.0 (DESIGN)

Streambed Elevation: 1791.0 Height of Dam: 16 ft

Reservoir Storage at Top of Dam Elevation: _____ acre-ft

Size Category: SMALL

Hazard Category: SIGNIFICANT (see Section 5)

Spillway Design Flood: VARIES 100-YR TO 1/2 PMF

SELECT 1/2 PMF

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
<u>NONE</u>				

DOWNSTREAM DAMS

<u>NONE</u>				

UNIT HYDROGRAPH DATA:

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

(5): Length of main watercourse extended to divide

$$T_D = C_t \times (L')^{0.6}$$

Computer Data: QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

PMF Rainfall Index= 22.1 in., 24 hr., 200 sq. mile.
Hydromet. 40 Hydromet. 33
(Susquehanna Basin) (Other Basins)

N/A

1.0

NIA

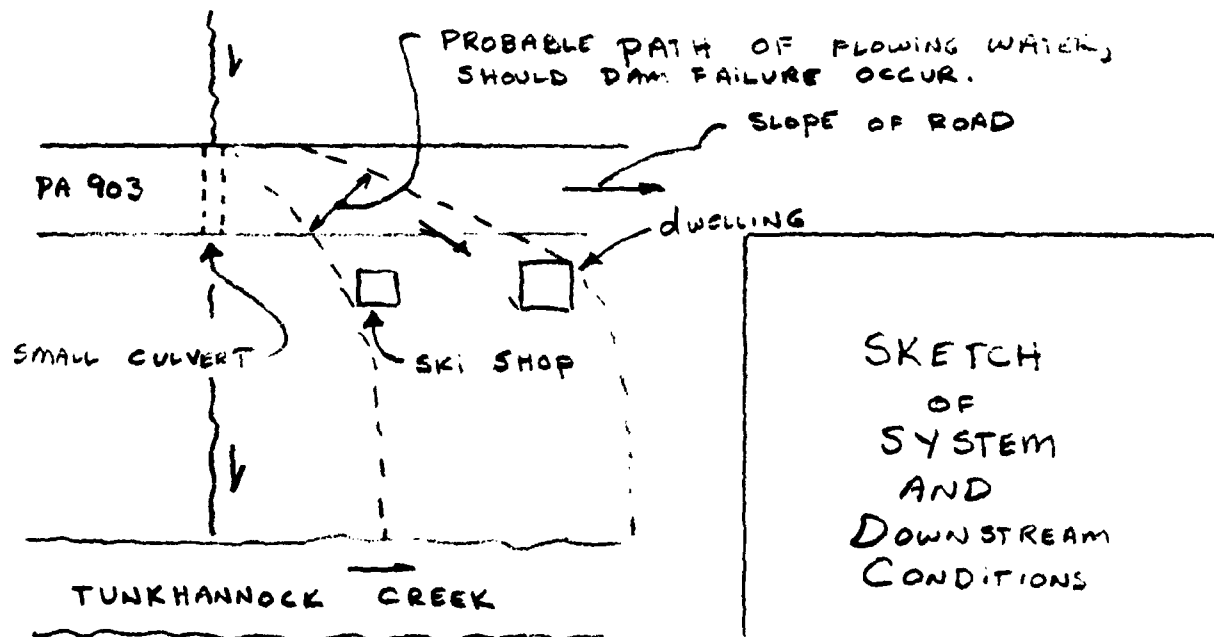
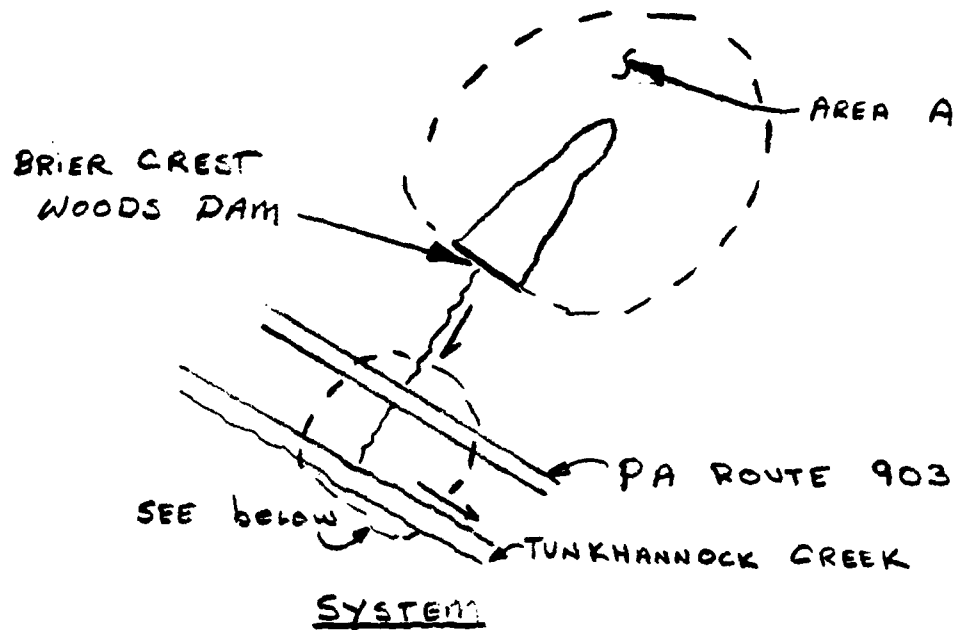
NIA

22.1

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	-
96 hours	-

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SKETCH
OF
SYSTEM
AND
DOWNSTREAM
CONDITIONS

DOWNSTREAM CONDITIONS

Data for Dam at Outlet of Subarea A (see Sketch on Sheet D-4)

Name of Dam: BRIER CREST Woods

SPILLWAY DATA:

	Existing Conditions	Design Conditions
Top of Dam Elevation	<u>1806.7</u>	<u>1807.0</u>
Spillway Crest Elevation	<u>1802.0</u>	<u>1802.0</u>
Spillway Head Available (ft)	<u>4.7</u>	<u>5.0</u>
Type Spillway	<u>NEAR - OGEE</u>	
"C" Value - Spillway	<u>SEE FOLLOWING SHEET</u>	
Crest Length - Spillway (ft)	<u>25</u>	<u>25</u>
Spillway Peak Discharge (cfs)	<u>923</u>	<u>973</u>
Auxiliary Spillway Crest Elev.	<u>N/A</u>	<u>N/A</u>
Auxiliary Spill. Head Avail. (ft)	<u>↓</u>	<u>↓</u>
Type Auxiliary Spillway	<u>↓</u>	<u>↓</u>
"C" Value - Auxiliary Spill. (ft)	<u>↓</u>	<u>↓</u>
Crest Length - Auxil. Spill. (ft)	<u>N/A</u>	<u>N/A</u>
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)	<u>923</u>	<u>973</u>

Spillway Rating Curve: SEE SHEET FOLLOWING

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
<u>1802.0</u>	<u>0</u>	<u>N/A</u>	
<u>1803.0</u>	<u>85</u>		<u>SEE G</u>
<u>1804.0</u>	<u>257</u>		<u>Spillway</u>
<u>1805.0</u>	<u>503</u>		
<u>1805.5</u>	<u>638</u>		
<u>1806.0</u>	<u>780</u>		
<u>1806.5</u>	<u>888</u>		
<u>1806.7</u>	<u>923</u>		
<u>1807.0</u>	<u>973</u>		
<u>1810.0</u>	<u>1376</u>	<u>↓</u>	
		<u>N/A</u>	

OUTLET WORKS RATING:

	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	<u>1791.5</u>		
Invert of Inlet	<u>1791.7</u>		
Type	<u>12" CMP IN CONCRETE</u>		
Diameter (ft) = D	<u>1</u>		
Length (ft) = L	<u>13'</u>		
Area (sq. ft) = A	<u>.79</u>		
N	<u>.024</u>		
K Entrance	<u>0.5</u>		
K Exit	<u>1.0</u>		
K Friction = $29.1 N^2 L / R^4 / 3$	<u>6.38</u>		
Sum of K	<u>2.88</u>		
(1/K) 0.5 = C	<u>.59</u>		
Maximum Head (ft) = HM	<u>15</u>		
Q = $CA \sqrt{2g(HM)}$ (cfs)	<u>14.48</u>		
Q Combined (cfs)	<u>± 15</u>		

D-5

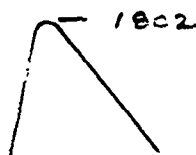
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FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SPILLWAY RATING CURVE
WEIR - SIMILAR TO "KINGS HANDBOOK
OF HYDRAULICS" FIG 73
 $C = 3.15 + .24 H$ $C_{MAX} = 3.9$

HEAD	C	$Q = CLH^{1.5}$	$POOL = HEAD + 1802$
0	3.15	0	1802.0
0.5	3.28	29	1802.5
1	3.40	85	1803.0
1.5	3.52	161	1803.5
2	3.64	257	1804.0
2.5	3.77	371	1804.5
3	3.89	503	1805.0
3.5	3.9	638	1805.5
4	3.9	780	1806.0
4.5	3.9	931	1806.5
5.0	3.9	1090	1807.0

 LOW CHORD = $1805.94 \approx 1806$



USE ORIFICE EQUATION $A = 4 \times 25 = 100$
 $Q = 0.7 \times 100 \times \sqrt{2g(Pool - 1804)}$

POOL	Q
1806.5	888
1806.7	923
1807.0	973
1810.0	1376

D-6

Data for Dam at Outlet of Subarea A (See sketch on Sheet D-4)

Name of Dam: BRIER CREST WOODS

STORAGE DATA:

Elevation	Area (acres)	Storage		Remarks
		million gals	acre-ft	
<u>1789.4</u> = ELEV0*	<u>0</u>	<u>0</u>	<u>0</u>	
<u>1802.0</u> = ELEV1	<u>26.2</u> = A1	<u>33</u>	<u>110</u> = S1	<u>DER RECORD</u>
<u>1806.7</u>	<u>28.4</u>		<u>238</u>	
<u>1807.0</u>	<u>28.5</u>		<u>247</u>	
<u>1820.0</u>	<u>35</u>			

* ELEV0 = ELEV1 - (3S₁/A₁)

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 9 percent of subarea watershed.

BREACH DATA: Not Used

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: _____

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) _____ fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = $(2/3) \times H$) & $A = L \cdot \text{depth}$

HMAX = $(4/9 V^2/C^2) =$ _____ ft., C = _____ Top of Dam El. = _____

HMAX + Top of Dam El. = _____ = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = _____ ft (width of bottom of breach)
Z = _____ (side slopes of breach)
ELBM = _____ (bottom of breach elevation, minimum of
zero storage elevation)
WSEL = _____ (normal pool elevation)
T FAIL = _____ mins = _____ hrs (time for breach to
develop)

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SELECTED COMPUTER OUTPUT
EXISTING CONDITIONS
MULTI-RATIO ANALYSIS

<u>ITEM</u>	<u>PAGE</u>
INPUT	D-9
SUMMARY OF PEAK FLOWS	D-10
BRIER CREST WOODS DAMS	D-11

D-8

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

	A1	A2	A3	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE</
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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO	RATIOS APPLIED TO FLOWS					
					RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
					1.00	.80	.60	.50	.40	.30
HYDROGRAPH AT	1	.48	1	1042.	834.	625.	521.	417.	313.	
	(	1.26)	(	29.51)(	23.61)(	17.71)(	14.76)(	11.80)(	8.85)(
ROUTED TO	1	.48	1	879.	710.	521.	429.	335.	237.	
	(	1.26)	(	24.88)(	20.12)(	14.76)(	12.14)(	9.67)(	6.71)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

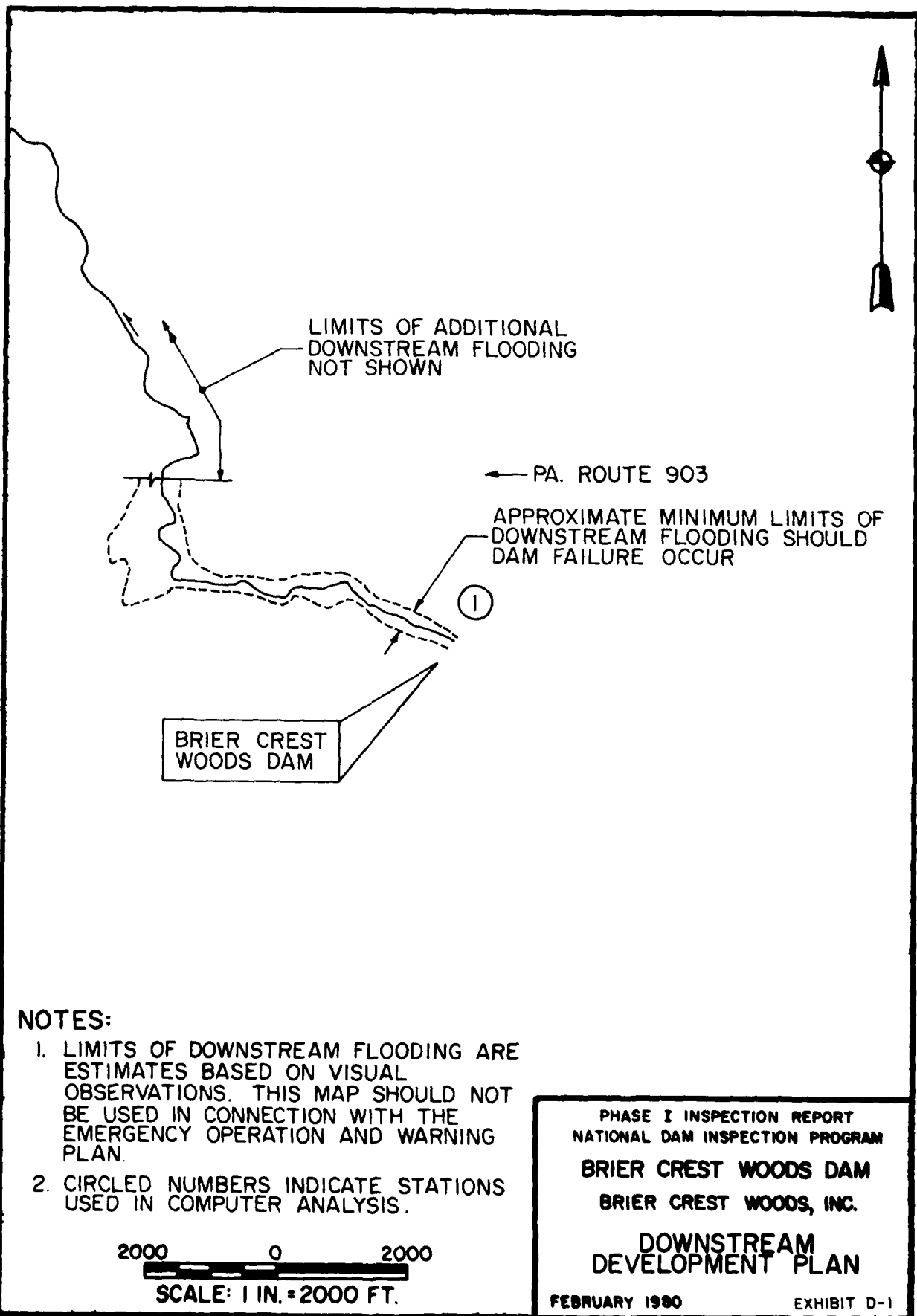
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 1802.00 110. 0.	SPILLWAY CREST 1802.00 110. 0.	TOP OF DAM 1806.70 238. 923.	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	MAXIMUM STORAGE AC-FT	MAXIMUM DEPTH OVER DAM	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1806.46					0.00	879.	231.	0.00	42.75	0.00
.80	1805.75					0.00	710.	212.	0.00	42.75	0.00
.60	1805.07					0.00	521.	193.	0.00	43.00	0.00
.50	1804.70					0.00	429.	182.	0.00	43.00	0.00
.40	1804.32					0.00	335.	172.	0.00	43.00	0.00
.30	1803.88					0.00	237.	160.	0.00	43.25	0.00

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

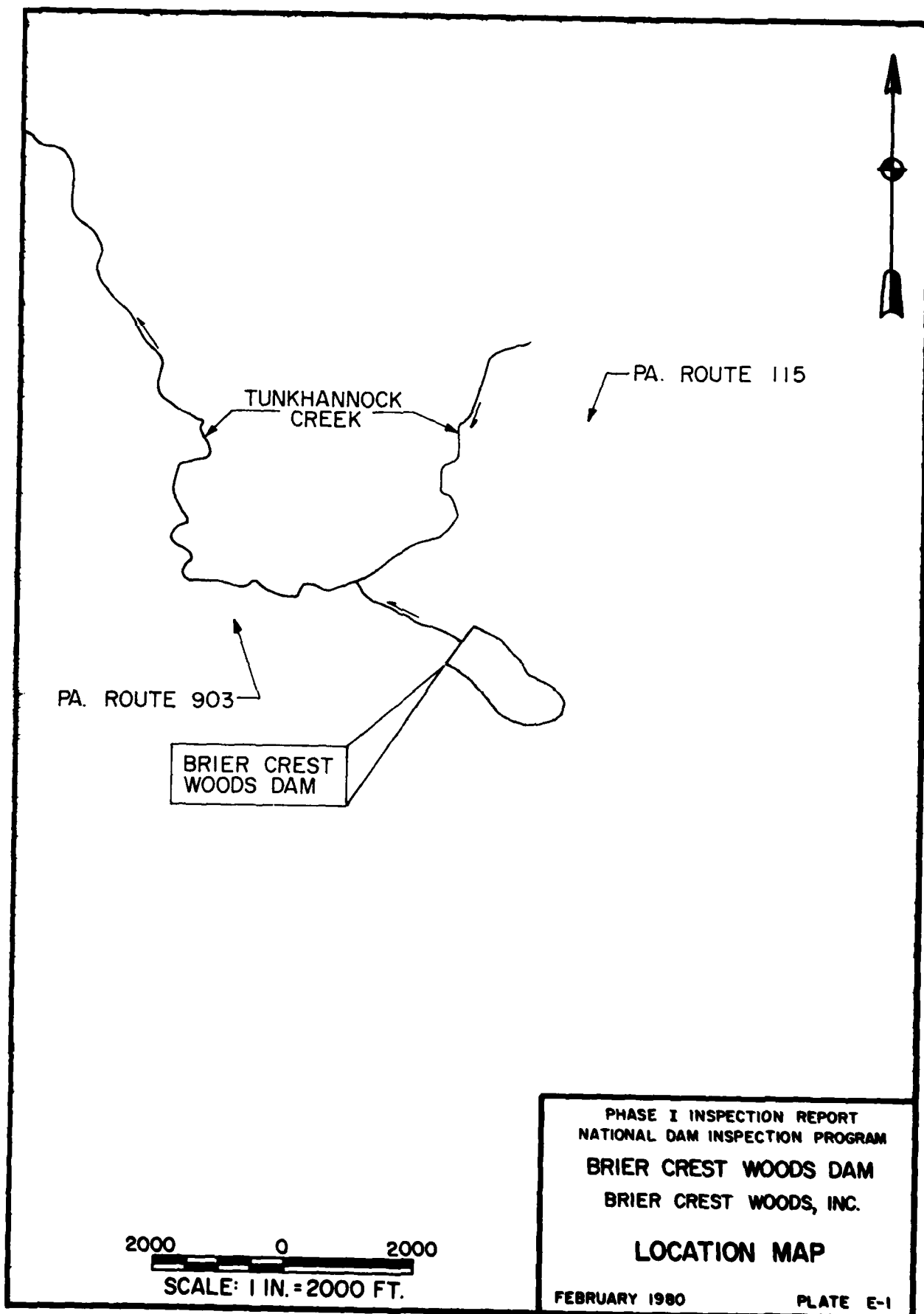
SUMMARY OF PERTINENT DATA
EXISTING CONDITIONS
PMF RAINFALL = 25.11"

	<u>PMF</u>	<u>1/2 PMF</u>
RUNOFF (INCHES)	22.93	11.47
INFLOW (CFS)	1042	521
OUTFLOW (CFS)	879	429
FREEBOARD (FT)	0.24	2.0

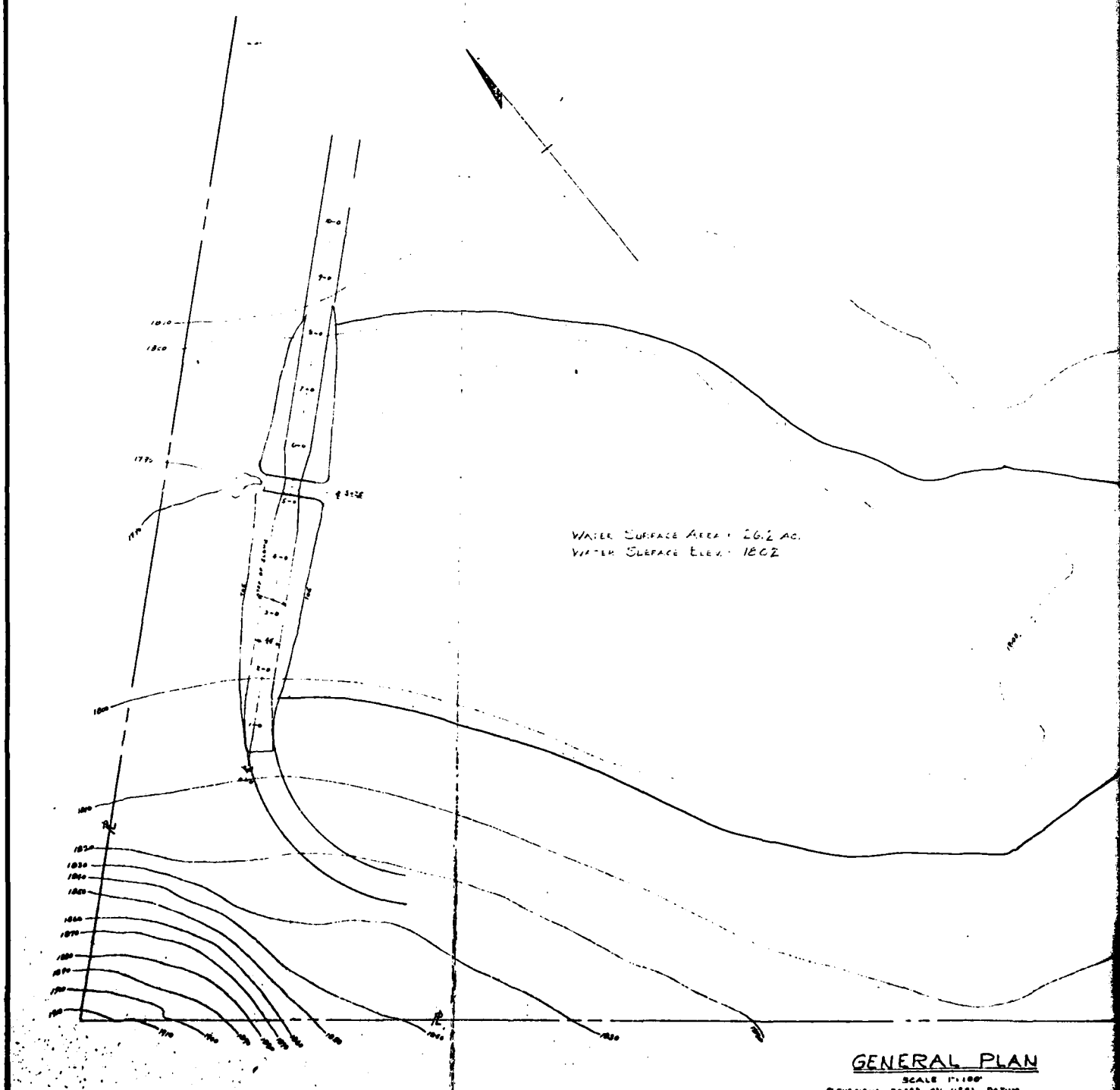


APPENDIX E

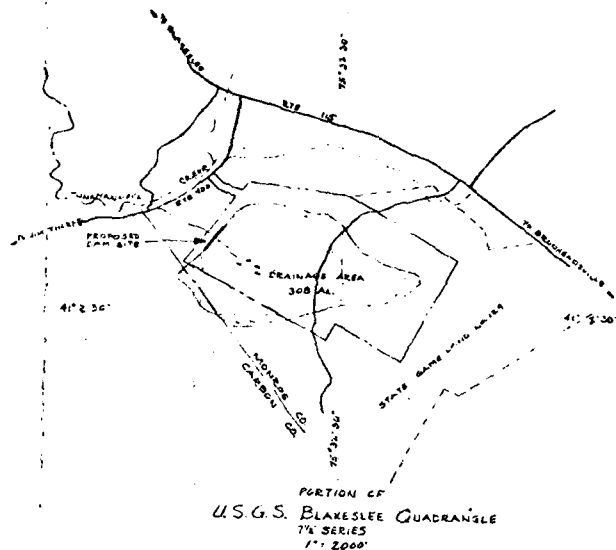
PLATES



CONSTRUCTION TO BE IN ACCORDANCE
DEPT. OF FORESTS AND WATERS FORM
DEPT. OF TRANSPORTATION FORM 40
OTHERWISE SPECIFIED ON PLANS



WITH
1 MILE-S AND
10 UNLESS



THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

CONTENT
LOCATION PLANS

41-245-1
FILE 3-220
RECEIVED BY THE OFFICE OF T.E. D. PARTIAL OF CIVILIAN RESEARCH SERVICES ON 5/1/79 FILE 3-220

PROPOSED DAM
BRIER CREST WOODS CORP
THURMANNOCK TWP - MONROE CO - PENNA
JUNE 6, 1979 SCALE AS SHOWN
EDWARD C. HERRICK INC.
STROUDSBURG, PA.

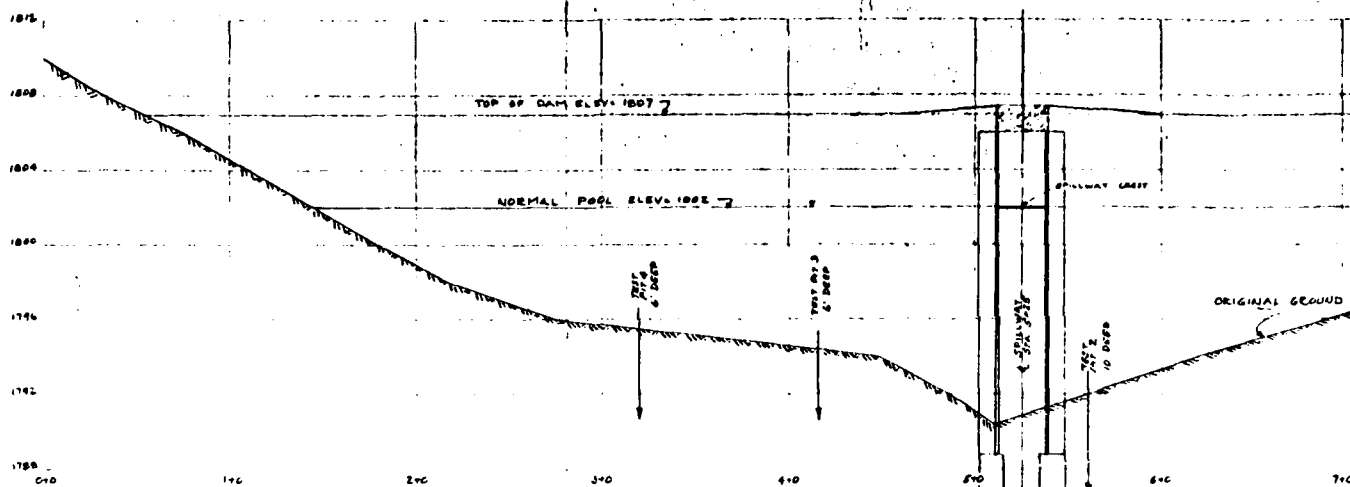
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
BRIER CREST WOODS DAM
BRIER CREST WOODS, INC.

GENERAL PLAN

FEBRUARY 1980

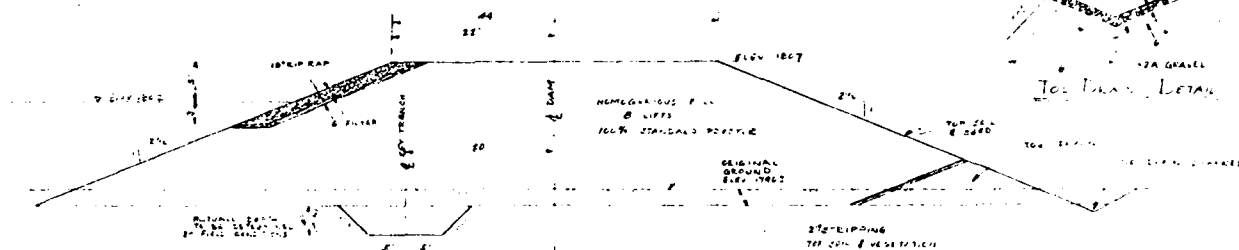
PLATE E-2

SHEET 1 OF 4

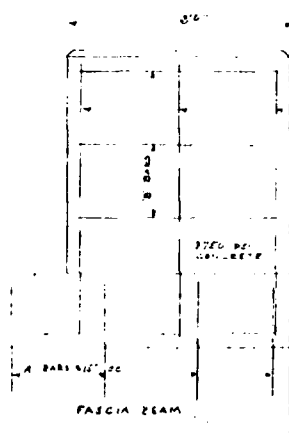


TEST PITS DUG WITH BACKHOE
18" LOAM AND ROOT MAT
SAME MATERIAL ALL HOLES - EXCEPT TO
ORANGE SILTY SAND FROM BOTTOM
OF LOAM TO BOTTOM OF HOLE

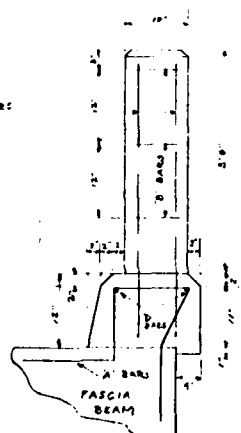
PROFILE OF DAM SITE
SCALE - HORIZ. 1" = 40'
VERT. 1" = 4'



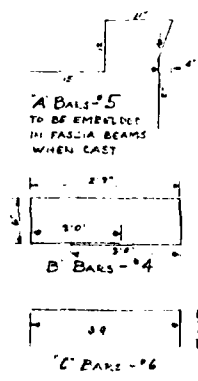
MAXIMUM CROSS SECTION
SCALE 1" = 10'



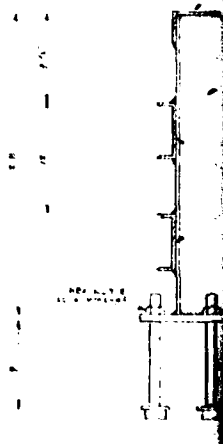
SIDE ELEVATION



END ELEVATION

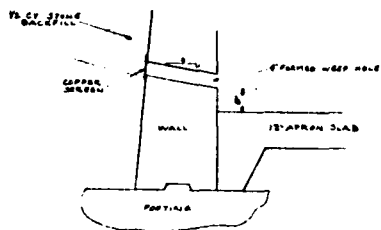


D BARS - 4 STRAIGHT



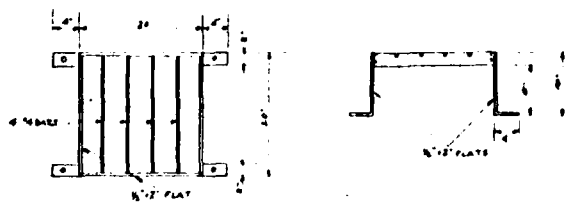
GUARD RAIL

CURE AND END POST



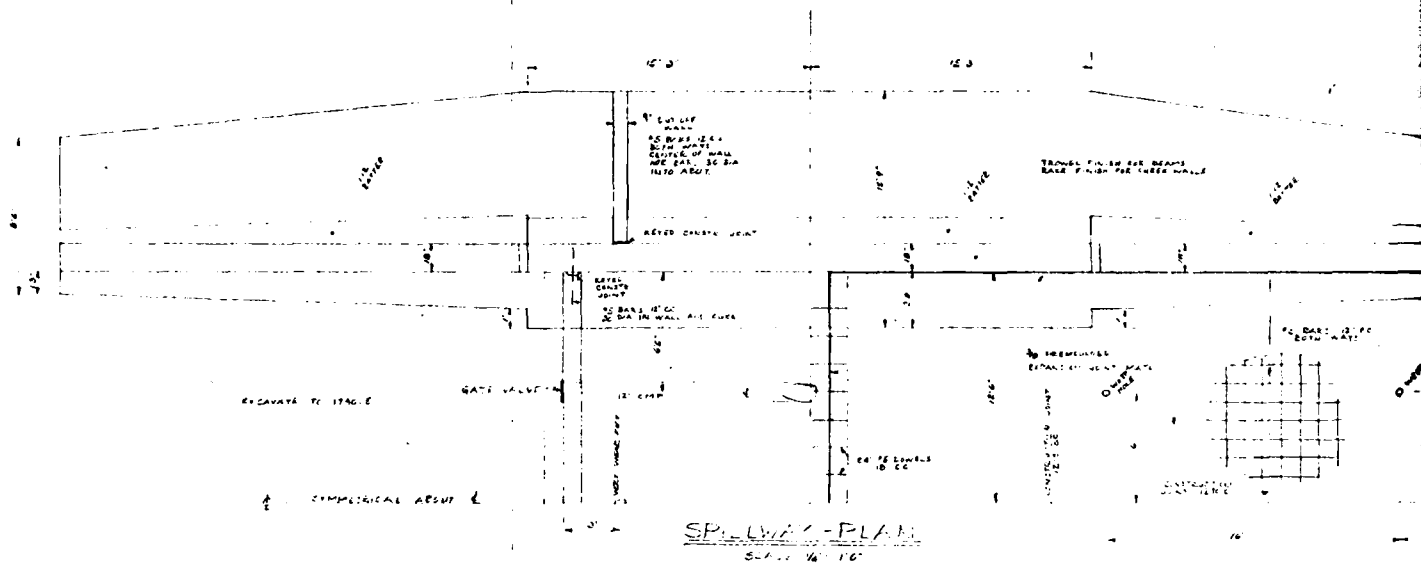
WEEP HOLE IN WALL - DETAIL

SLUICE GATE
 ARMCO MODEL 3A-10 SLUICE GATE
 SELF-CONTAINED - NON-RISING STEM
 FLAT BACK - 12" ROUND OPENING
 MATERIAL COMBINATION #2
 1/8" DIA STEM
 HB-18 LIFT TYPE I STEM GUIDE
 ARMCO WALL BRACKET
 F TYPE WALL THIMBLE



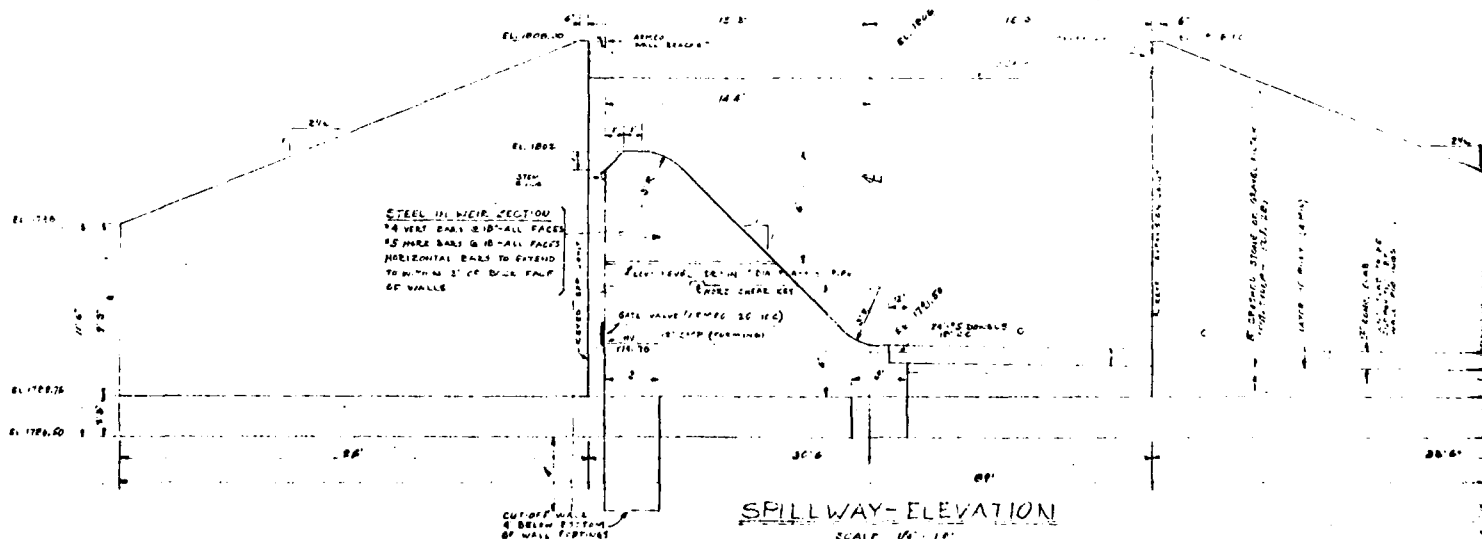
GRADE FOR GATE VALVE

WELD ALL JOINTS - ATTACH WITH ANCHOR BOLTS



SPILLWAY - PLAN

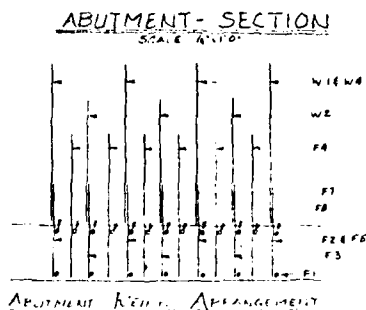
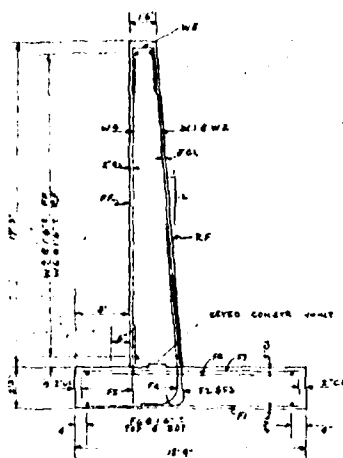
SCALE 1/4\"/>



SPILLWAY - ELEVATION

SCALE 1/4\"/>

REMARKS		DATE		AMOUNT	
3	3	3	3		30
31	31	31	31		30
32	32	32	32		30
33	33	33	33		30
34	34	34	34		30
35	35	35	35		30
36	36	36	36		30
37	37	37	37		30
38	38	38	38		30
39	39	39	39		30
40	40	40	40		30
41	41	41	41		30
42	42	42	42		30
43	43	43	43		30
44	44	44	44		30
45	45	45	45		30
46	46	46	46		30
47	47	47	47		30



NOTES - PVC WATER STOP TO BE USED IN ALL JOINTS

ВМС Украины - Летать

ALL CO. COST 3000.00

CONTENT

45-645-3
RECEIVED
U. S. DEPARTMENT OF ENVIRONMENTAL PROTECTION
ON 2/12/78
FILE CLERK

PROPOSED DAM
BRIER CREST WOODS CORP.
TUNKHANNOCK TWP - MONROE CO - PENNA
JUNE 4, 1991
SCALE AS SHOWN

BRIER CREST WOODS CORP.

TOWNHANNOCK TWP - MONROE CO - PENNA
JUNE 4, 1971 SCALE AS SHOWN

JUNE 4, 1971

WARD CHESS ASSOC INC
STPAULSBURG, FL

STANBURY, PA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

BRIER CREST WOODS DAM

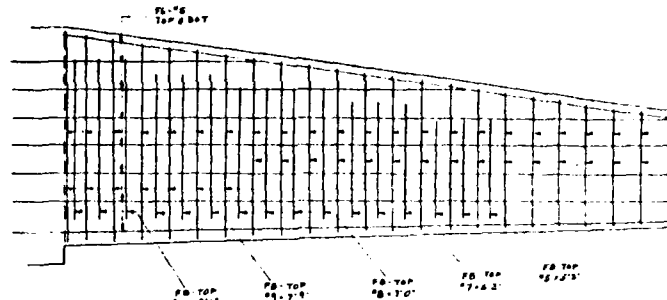
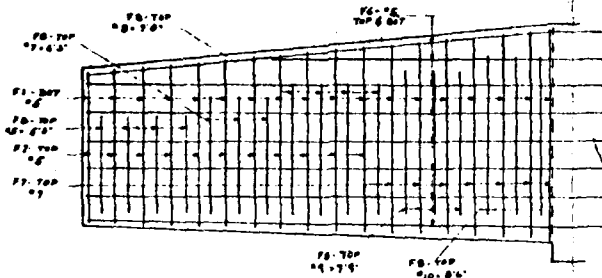
BRIER CREST WOODS, INC.

SPILLWAY

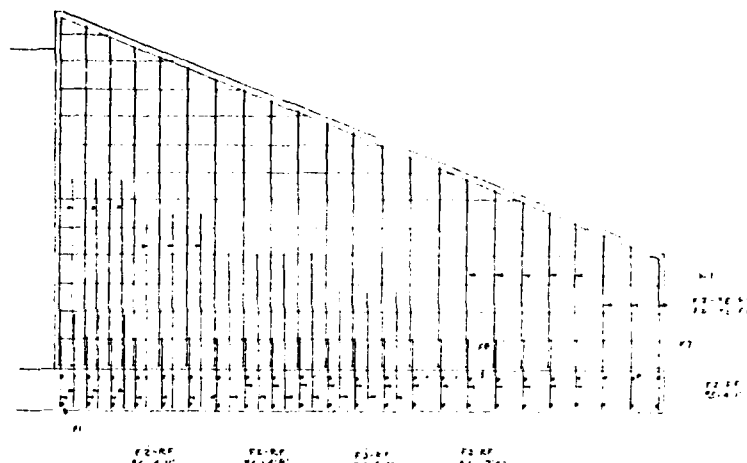
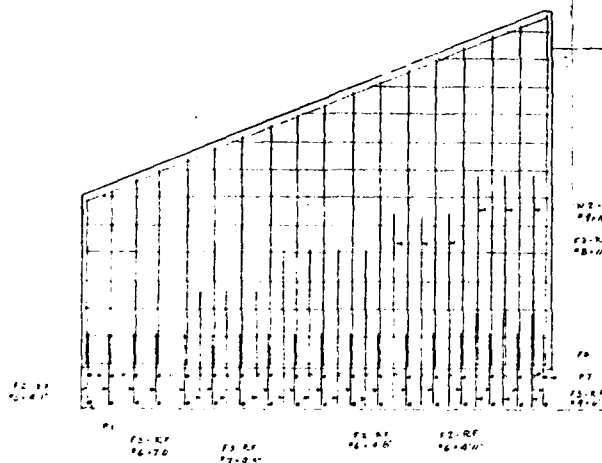
FEBRUARY 1980

PLATE E-4

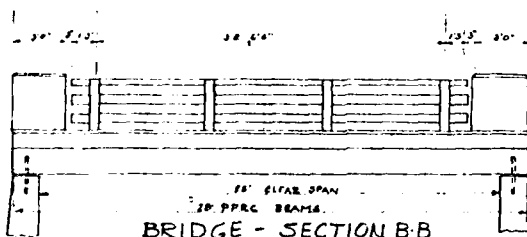
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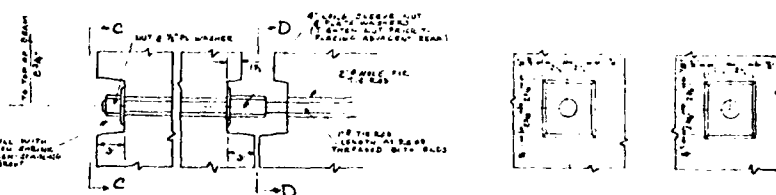
WING WALL - PLAN
REIN. ARRANGEMENT
SCALE 1/4" = 1'-0"



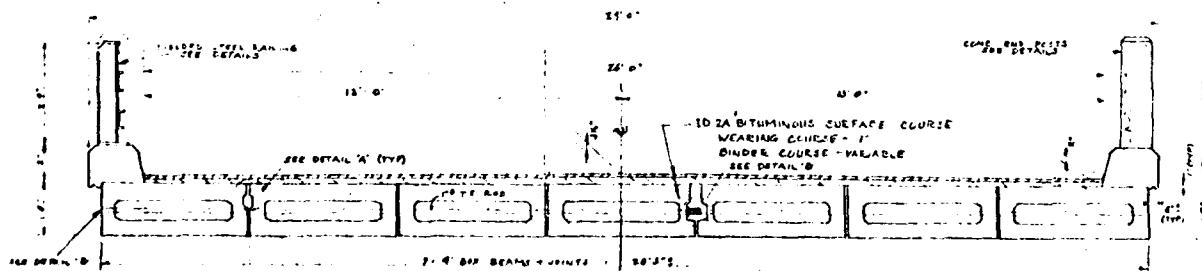
WING WALL - ELEVATION
REIN. ARRANGEMENT
SCALE 1/4" = 1'-0"



BRIDGE - SECTION B-B
SCALE 1/4" = 1'-0"

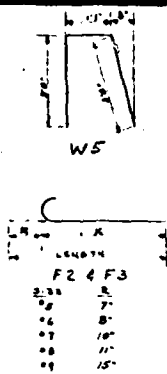


DETAIL B - TIED ROD

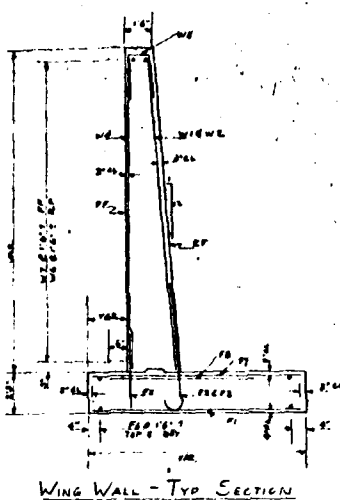


BRIDGE - SECTION A-A
SCALE 1/4" = 1'-0"

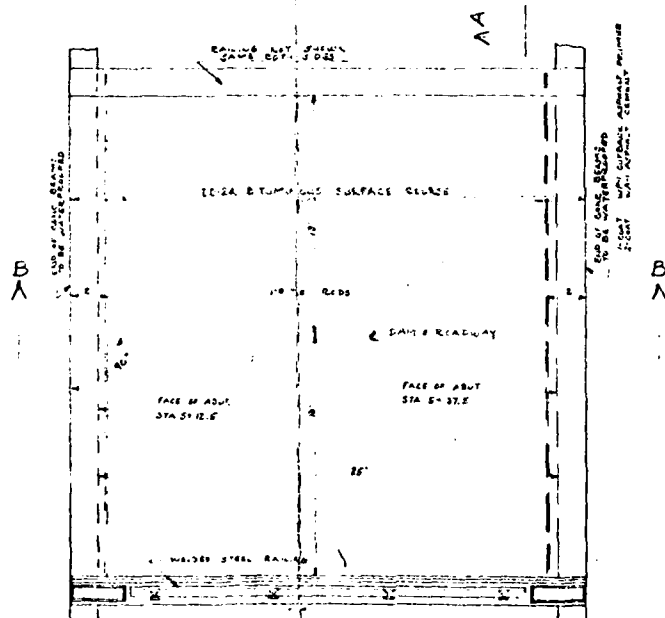
NOTES: REINFORCEMENT ON BEAMS AND
SLABS SHALL BE FABRICATED
WITH THE SAME AS REINFORCEMENT
TRANS.



SEE PLAN & ELEV. FOR SIZES AND VARIABLE LENGTHS



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BRIDGE - PLAN VIEW

CONTENT
BRIDGE DETAILS
WING WALL REINFORCING

45-24524
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HEALTH & SAFETY
ON 5/11/83
BY [Signature]

PROPOSED DAM
BRIER CREST WOODS CORP.
TUNKHANNOCK TWP. - MONROE CO. - PENNA.
JUNE 4, 1971
SCALE AS SHOWN

EDWARD C. NESS ASSA. INC.
STROUDSBURG, PA.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
BRIER CREST WOODS DAM
BRIER CREST WOODS, INC.

SPILLWAY DETAILS

FEBRUARY 1980

PLATE E-5

SHEET 4 OF 4

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APPENDIX F

GEOLOGY

BRIER CREST WOODS DAM

APPENDIX F

GEOLOGY

Brier Crest Woods Dam is located in Monroe County within the Appalachian Plateau Province. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Plateau Escarpment. The escarpment has a well-defined southwestward trend from Camelback Mountain, but is more irregular between Camelback and Mt. Pocono, which lies to the north. Streams east of the escarpment drain directly to the Delaware River, while those to the west drain to the Lehigh River.

The Pocono Plateau Section lies to the west of the escarpment. This area is relatively flat, with local relief seldom exceeding 100 feet. The topography has been greatly influenced by continental glaciation. Many features were created by deposition of glacial materials. The entire plateau lacks well-developed drainage.

East of the escarpment is the Glaciated Low Plateaus Section of the province. This area is characterized by pre-glacial erosional topography with locally-thick glacial deposits. Local relief is generally 100 to 300 feet.

Bedrock units of the sections described above are the lithified sediments of offshore marine, marginal marine, deltaic and fluvial environments associated with the Devonian Period. These units include siltstones of the Mahantango Formation, siltstones and shales of the Trimmers Rock Formation, and seven mapped members of the Catskill Formation. These members include sandstones, siltstones, and shales of the Towamensing Member; sandstone, siltstone and shale of the Walcksville member; sandstones, siltstones and shale of the Beaverdam Run Member; sandstone and shale in the Long Run Member; sandstones and conglomerates in the Packerton Member; sandstones and some conglomerates in the Poplar Gap Member; and sandstones and conglomerates in the Duncannon Member.

Brier Crest Woods Dam is underlain by the Poplar Gap Member of the Catskill Formation. The Poplar Gap Member is predominantly a gray sandstone and conglomeratic sandstone with interbedded siltstones and shales. Sandstones present

are thick-bedded, fine-to coarse-grained and exhibit very low primary porosity due to a clay and silica matrix. Effective porosity results from fractures and parting planes. Conglomeratic sandstone occurs primarily as concentrates of sub-round to round quartz pebbles. The siltstones and shales at the site are thin-bedded and also have low porosity.

The rocks are well-indurated and generally are not susceptible to slope failure; however, the presence of well-developed bedding and joint planes will result in some rockfall from vertical and high-angle cut slopes.

Bedrock is entirely overlain by glacial till of Late Wisconsin Age. This till is an unsorted mixture of clay, silt, sand, and gravel. It is moderately cohesive and is derived locally from the sandstones of the Catskill Formation. Thickness of the till varies from 5 to 75 feet. The dam is founded on this till.

